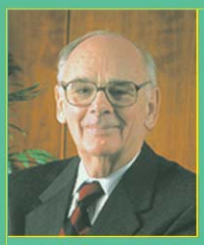
Research and Special Programs Administration

the VOLPE center

National Transportation Systems Center

HIGHLIGHTS

Cambridge, Massachusetts July/Aug 2002



Director's Notes

A Systems Perspective on Transportation Security

The Volpe Center has developed an integrated systems perspective for transportation security that applies multimodal systems planning as well as engineering expertise and capabilities. The Center's security work encompasses three areas: identifying vulnerabilities in the transportation system, introducing preventive measures and protecting targets, and managing the consequences of a terrorist attack.

The national transportation system is a network of many modal systems that provides unparalleled accessibility and mobility. However, the highly integrated nature of the system, which makes it so integral to our economy and quality of life, makes it particularly vulnerable. An attack on any of its parts can threaten the security of the entire system. Thus understanding the potential vulnerabilities of people and infrastructure involves identifying and analyzing specific threats.

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U.S. Department of Transportation

Focus

Improving Regional Transportation Planning for Catastrophic Events (FHWA)

Recent catastrophic events have heightened awareness of the importance, as well as the vulnerability, of transportation systems and the need for improved emergency response planning. The Federal Highway Administration's (FHWA) Office of Operations is working to incorporate lessons learned from recent events into future emergency response planning across the country with the assistance of the Volpe Center.

Center staff is supporting a comprehensive FHWA effort to examine the impacts of four recent catastrophic events on transportation systems and to understand what actions were taken in response to the events. Volpe staff developed two case studies and oversaw the development of two others. The four case studies analyzed information from literature reviews and interviews with key participants, and will be used to help promote discussion at a series of regional emergency preparedness workshops sponsored by FHWA this year.

The Volpe Center analyzed recent catastrophic events and determined lessons learned that should be considered in future transportation emergency response planning. The Volpe reports provided a foundation for FHWA emergency preparedness workshops being held throughout the country. (Photos courtesy of [left to right] California Dept. of Transportation, Port Authority of New York and New Jersey, AP/World Wide Photo.)

The studies document the actions taken by transportation agencies in response to:

- New York City, September 11, 2001
- Washington, D.C., September 11, 2001
- Baltimore, Maryland, rail tunnel fire, July 18, 2001
- Northridge, California, earthquake, January 17, 1994.

Each of these events occurred with no warning and resulted in substantial, immediate, and adverse impacts on transportation, and each has had varying degrees of influence on the longer-term operation of transportation facilities and services in its respective region. Each event revealed important information about the response of the transportation system to major stress and the ability of operating agencies and their public safety and emergency management partners to respond effectively to a crisis. The reports emphasize the transportation aspects of the catastrophic events and lessons learned that could be incorporated into future emergency response planning.

Each study addressed the following questions:

- *Were the key players prepared?*
- *What happened and who took action?*
- *What aspects of the emergency response worked well; what did not; and why?*
- *What role did technology play?*
- *What was learned, what could be done differently, and what can be incorporated into the planning process?*

Lessons Learned

After analyzing all the information gathered in research and interviews, the Volpe team concluded that the following five lessons learned should be considered in future planning.

1. Pre-existing relationships among agencies and personnel are key to emergency management success. Well-established relationships among the many transportation and emergency personnel in New York formed one of the most important success factors in managing the post-attack situation. The response to the Northridge earthquake was also greatly facilitated by pre-existing interagency relationships. Such relationships help transcend the different response approaches used by transportation, military, and law enforcement agencies.

2. Preparedness planning is another crucial element, and must include the development of an emergency response plan and training for all shifts of workers. In Northridge, New York, and Washington, previous catastrophes had prompted regional agencies to develop plans, establish or upgrade operations centers, and participate in emergency drills. Planning helps establish relationships and define roles and responsibilities.

Training field personnel as well as managers is vital, for they often must make critical decisions with little or no input from senior staff. In New York, many key transportation personnel were missing or out of contact for the first few hours on September 11. Nevertheless, thanks to the quick decisions of field staff, agencies were responding within minutes of the attack.

Packed New York City subway train on the morning of September 11 after the attack. (Photo courtesy of AP/World Wide Photo.)

3. Redundancy must be built into institutions and physical systems, including personnel, communications, utilities, and control centers. A new approach to redundancy is needed – a backup is not adequate if it is also exposed to failure in an emergency. The transportation infrastructure facilitates emergency response and evacuation, so an alternative network is critical, as are remote backup operations and emergency management facilities. New York's Office of Emergency Management had been located in the World Trade Center; a temporary office had to be re-located three times on September 11.

4. Multiple technical communication methods help ensure proper institutional communication. Redundancy and resiliency in communications is critical. Systems that depend on cell phones or landlines can be unreliable; an emergency response system should include both alternative technologies and redundant network connectivity. Available communication modes can be dependent on the nature and location of a particular event. Immediately following the Northridge earthquake, cell phones and radio were the only means of communication for emergency personnel. However, service was unreliable in the canyon areas, where most of the damage occurred. Staff had to fill the gap with pagers, fax machines, and electronic data sharing via computers. In New York, cellular and radio towers were destroyed, and landlines were limited. Interagency communication was aided by other methods, such as email, dedicated cell phones, two-way radios, and wireless email.

One of the primary transportation actions taken in Washington on September 11 was closing I-395 inside the Beltway to facilitate movement of emergency vehicles. (Photo courtesy of the Federal Emergency Management Administration)

5. Advanced technologies play an important role in communications and decision making. Traffic management centers, closed-circuit TV, sensor systems, dynamic message signs, advanced traffic control systems, Web sites, and geographic information systems were all identified as useful in aiding internal and external communication; the first six of these tools are associated with intelligent transportation systems (ITS).

Timely decision making requires effective communication of accurate information. In the aftermath of disaster, ITS enabled facility managers to: make informed decisions, improve regional transportation management, and enhance communication with the public. In the Washington area, traffic signal systems were adjusted to facilitate the rush of commuters from the District, and to enable access by emergency responders. In New York, TRANSCOM used traffic volume data to enable agencies to better distribute traffic, and the ITS package on the George Washington Bridge helped manage its closing and reopening. Highway advisory radio, dynamic message signs, and closed circuit television provided public information.

Providing the Foundation for Emergency Preparedness Workshops

The four case studies will be used as intended in a series of ten regional workshops sponsored by the Office of Operations that will bring transportation officials and emergency response providers together to discuss emergency preparedness and the role that transportation plays in response and recovery. These workshops are designed to enhance working relationships of personnel from different organizations in the region, and to identify areas for improvement in planning and readiness in the region. They will also help determine next steps and provide input to emergency preparedness guidance being developed at the national level.

The FHWA workshops will help incorporate lessons learned into future emergency response planning across the country.

Continuing Support to FHWA

Volpe work on this important project will continue over the next several months as the team develops a crosscutting study summarizing the findings of the four case studies for high-level decision makers.

The Volpe team that conducted the reviews was led by Mr. Allan DeBlasio of the Planning and Policy Analysis Division; Mr. DeBlasio also presented the findings at the Northeast Association of State Transportation Officials in April 2002.

Helping to Keep the Mail Safe (USPS)

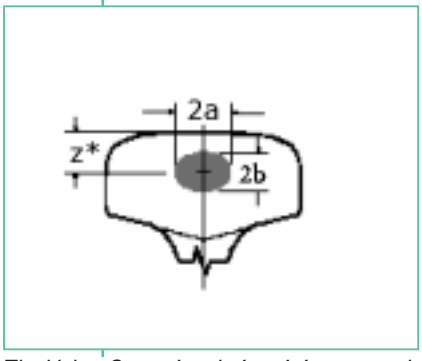
The Volpe Center provides technical support to the Hazardous Materials (HAZMAT) Program of the U.S. Postal Service (USPS). As part of its educational outreach program, the USPS conducts biannual national forums with its major customers to provide information about new USPS activities and demonstrate improved mailing operations. The spring forum was held in San Diego, California from April 22 through 24, 2002. Mr. Glenn Goulet of Volpe's Environmental Engineering Division assisted in the presentation of "Hazardous Materials – What a Mailer Needs to Know."

Volpe staff also support the HAZMAT Program by developing training and awareness materials for USPS employees and customers. Recent materials that promote the theme "Keep the Mail Safe" include lapel pins and a HAZMAT poster now displayed in all post office lobbies nationwide.

Lapel pins remind USPS customers to avoid shipping potentially hazardous materials and "Keep the Mail Safe."

Improving Rail Structural Integrity (FRA)

Improving railway safety by reducing rail failures and the associated risks of train derailments is an objective of many railroad organizations throughout the world. In 1997, the Union Internationale des Chemins de fer (UIC, or International Union of Railways) began an international research project on Rail Defect Management with the goal of developing and implementing strategies to control the risk of rail failures. The UIC, with headquarters in Paris, France, promotes cooperation among railways at the global level.



The Volpe Center's role in a joint research project on rail defect management involves modeling the growth of internal rail defects observed in project testing.

The primary method for controlling the risk of rail failures is rail testing. Determining how often rail tests should be performed requires knowledge of the nature of rail defect growth. The UIC project includes studies examining the growth of rail defects under both laboratory and revenue service conditions. The Volpe Center is conducting engineering analyses to model the growth behavior observed in the laboratory and in field tests. The Center is performing this work in support of the Federal Railroad Administration (FRA), which is a member of the UIC.

The Volpe Center hosted an ad-hoc project meeting in May 2002, to discuss specific technical details of the Center's project work and how it can be used in risk analysis. Volpe participants included Dr. David Jeong, Dr. Oscar Orringer, and Ms. Yim Tang of the Vehicle Crashworthiness Division, and Mr. Jeffrey Gordon and Mr. Andrew Sluz of the Structures and Dynamics Division. Other participants included the Project Manager and representatives from the Railway Technical Research Institute in Japan and the Transportation Technology Center in Pueblo, Colorado.

During the week of June 24, 2002, Dr. Jeong attended a working group meeting in Paris where all participating organizations presented status reports on their research. Dr. Jeong is preparing a series of reports describing Volpe's analyses and results that will be submitted to the UIC at the conclusion of the project, which is scheduled for December 2002.

Broken rail from laboratory testing that studied the growth rate of internal rail defects. These experiments were performed by one of the several organizations participating in the UIC joint research project. (Photo courtesy of UIC)

Mobility & Economic Growth

Small Business Innovation Research Annual Report Submitted (U.S. DOT)

The DOT Small Business Innovation Research (SBIR) Program helps ensure that small firms participate in DOT research and technology contracts. Mr. Joseph Henebury of the Communications and Technology Outreach Division manages the DOT SBIR Program Office, which recently submitted the FY 2001 annual report to the U.S. Small Business Administration. In FY 2001, small businesses received total obligations of $7.1 million, including $2.9 million in Phase I obligations sponsored by the Federal Highway Administration, the Federal Aviation Administration, the National Highway Traffic Safety Administration, the Federal Railroad Administration, the Federal Motor Carrier Safety Administration, the U.S. Coast Guard, and the Research and Special Program Administration; $1.3 million in Phase II obligations; and $2.9 million in incremental obligations.

Each year, small businesses throughout the United States submit proposals offering innovative solutions to evolving challenges and requirements of the transportation enterprise. On October 1, 2002, Phase I proposals recommended for 2002 awards will be posted on the SBIR Web site (*www.volpe.dot.gov/sbir/*).

The DOT SBIR Program encourages small businesses throughout the United States to submit proposals for innovative solutions to specific transportation problems.

Developing Programmatic Communications Products (FHWA)

The introduction of Intelligent Transportation Systems (ITS) such as electronic toll collection, electronic fare payments, dynamic message signs, and traffic signal control systems has transformed the transportation profession. ITS provides transportation professionals with the tools to manage, operate, and maintain transportation systems in real time. Since 1996, two DOT programs have been helping transportation professionals optimize the benefits of ITS. The ITS Professional Capacity Building Program (PCB) provides training and education on these new information and communication technologies. The Volpe Center, working closely with the ITS PCB Program Coordinator, designed and implemented a comprehensive, nationwide program. For the ITS Standards Program, the Center is supporting an outreach campaign to build awareness of and demand for standards-based ITS.

The Volpe Center designed a series of marketing and outreach products for the DOT's ITS PCB Program, including a new interactive Web site (www.pcb.its.dot.gov).

At the recent ITS America Annual Conference in Long Beach, California, Ms. Suzanne Sloan, Ms. Dana Larkin, and Mr. Gerry Flood of the Planning and Policy Analysis Division unveiled new communications products on behalf of the ITS PCB Program and the ITS Standards Program. As requested by the PCB sponsor, Mr. Ron Giguere, Volpe designed a series of marketing and outreach products. A new exhibit backdrop, information folder, redesigned Web site, and a new tool known as the ITS Curriculum Guide were displayed in the exhibit hall with great success.

In a similar vein, the ITS Standards Program sponsor, Mr. Mike Schagrin, has tasked the Volpe Center with translating the technical work of the last six years into useful articles, case studies, and products that can help the ITS practitioner in the field apply ITS standards during deployment. Mr. Flood has worked closely with the ITS Standards Program to develop new Web-based products and a series of application tools. Distribution of materials at the conference revealed a great need and demand for this information. In all, the work of the last six months has helped move both of these programs into the forefront of ITS programmatic communications and outreach.

Volpe staff are developing materials to help agencies deploy standards-based ITS. Most of the tools are available on CD or online from the DOT's ITS Standards Program. (www.its-standards.net)

Human & Natural Environment

Monitoring Environmental Compliance at Superfund Sites (U.S. EPA)

Long-term Superfund actions address the largest and most complex hazardous waste cleanups. Typically involving contaminated soils and drinking water supplies, or extensive site remediation, they can cost millions of dollars and may take up to 30 or more years to complete. For the Environmental Protection Agency (EPA) staff responsible for these projects, managing the vast amounts of technical data generated for each project is daunting. Working with EPA Region 5's Superfund Division, the Volpe Center has developed a data management and analysis system that helps EPA managers monitor and validate the cleanup progress at Superfund sites. The Environmental Data Management and Analysis Network (EDMAN) has been successfully piloted in Region 5, and is now available for use by other EPA regions. EPA Region 5 covers Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.

The first system of its kind, EDMAN enables the EPA to monitor and validate the progress of cleanup at Superfund sites.

Currently, more than 400 sites in Region 5 are being cleaned up. Remediation is performed by contractors for the party deemed responsible for the contamination and its cleanup, or, if that party is not known, the EPA. Contractors submit regular monitoring reports to EPA Remedial Program Managers, who must ensure that the remediation is effective and determine when the site is clean and usable. Given the large number of projects and its limited

resources, the EPA has often been unable to process the monitoring data in a meaningful way, and has depended on the contractor's reports, which have been submitted in a hard copy, tabular format that is difficult to analyze.

The EPA recognized that its managers needed sophisticated data management and analysis tools. The Volpe Center responded with EDMAN, which automates data management, analysis, and presentation. Now contractors submit monitoring reports in a Volpe-developed electronic template as well as hard copy. EDMAN processes the data, e.g., site maps, geologic data, contamination data, site properties, and groundwater levels; validates and tracks the data; and uses it to visualize site conditions. Visualization helps to promote a clear understanding of current conditions and to predict future conditions, enabling timely corrections that keep the project on track.

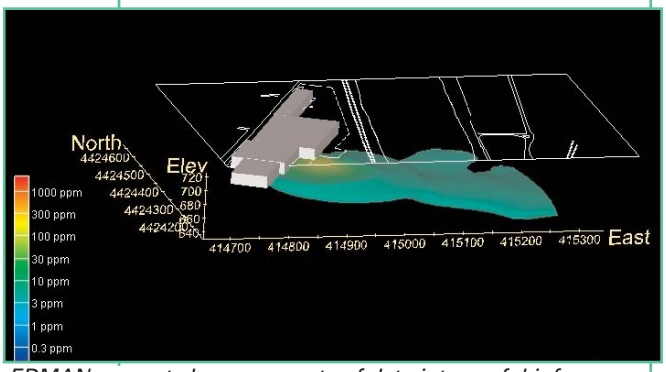
What began as a straightforward software integration project soon evolved into a multidisciplinary effort as the Volpe staff realized that to meet EPA's needs completely, they needed to fully understand the relevant environmental issues as well as geographic information systems (GIS). To accomplish this, the Center assembled an integrated, multidisciplinary project team that is providing environmental engineering as well as information systems services, supported by GIS. The Volpe team has:

- Evaluated off-the-shelf data management, visualization, and modeling tools.
- Selected, acquired, and integrated 10 software packages into one system.
- Developed the process, procedures, and formats for data submittal. Volpe's environmental expertise was needed to interface with EPA staff, understand what they wanted the system to do, make suggestions, and test the tools.
- Automated all site-specific information in GIS.
- Performed statistical analysis of groundwater sampling data for a Superfund site. The results revealed that a number of contractor-proposed Contaminant Action Levels were set too high. EPA is using Volpe's analysis to negotiate lower levels for that site.
- Trained EPA staff in the optimal use of EDMAN.

Volpe team members include Mr. William Halloran and Mr. Steve Losier of the Environmental Engineering Division, Mr. Bob Hallett of the Service and Operations Assessment Division, and Ms. Rebecca Bergquist of EG&G Technical Services, Inc. (a Volpe contractor).

EDMAN enables the EPA Superfund Division to:

- Manage the vast amount of site data they receive;
- Validate contractors' data;
- Monitor remediation efficacy;
- Track cleanup progress;
- Create informative material for public presentations; and
- Return sites to usable condition more efficiently and cost-effectively.



EDMAN converts large amounts of data into useful information. For example, it can perform a statistical analysis of a contaminant plume and present the results in 3-D. When illustrated, the impact of a groundwater plume is easier to comprehend than sheets of numbers.

Volpe Hosts the National Alternative Fuel Vehicle Odyssey Day

Mr. Dean Kamen, inventor of the Segway Human Transporter, was the keynote speaker at National Alternative Fuel Vehicle Odyssey Day. (Photo courtesy of Ms. Diane Wells)

The Volpe Center served as regional host site for the National Alternative Fuel Vehicle (AFV) Odyssey Day on April 11, 2002. The purpose of AFV Odyssey Day is to educate future generations of vehicle users about new choices in clean transportation and careers in the AFV industry. More than 500 students, fleet operators, industry representatives, and educators attended the event, where they could ride a fuel cell powered bus, drive GEM and TH!NK electric cars, and see a broad spectrum of other light-duty passenger and commercial alternative fuel vehicles and infrastructure. Mr. Dean Kamen, inventor of the Segway Human Transporter, was the keynote speaker. In addition, AFV industry practitioners, Environmental Protection Agency personnel, and vehicle manufacturer representatives spoke to the students about professional opportunities in the AFV sector. AFV Odyssey Day also featured a roundtable discussion where industry representatives, academia, and users discussed Boston's alternative fuel infrastructure and various AFV commercial applications and opportunities. The event was sponsored by the Wentworth Institute of Technology, the National Alternative Fuels Training Consortium (funded by the Environmental Protection Agency), and the Massachusetts Clean Cities Coalition.

Organizational Excellence

Implementing Project Management Teams (DDOT)

A Volpe team has been supporting the District of Columbia Department of Transportation (DDOT) in its efforts to improve transportation infrastructure management. To optimize its operation, DDOT has separated from the Department of Public Works and is now adopting a project management team approach to improve the planning, design, and construction of infrastructure projects. Early in 2001, Dr. Jeffrey Bryan and Ms. Cassandra Callaway of Volpe's Planning and Policy Analysis Division began working with the DDOT to develop a plan for how the agencies would divide. The plan was accepted by the Mayor of Washington, D.C., in April 2001. (See Volpe Highlights, April-May 2001.)

At the same time, the Mayor began implementing a neighborhood-based approach to providing city services. DDOT saw this as an opportunity to change the organization of the infrastructure division from disparate functional stovepipes to cross-functional, project management teams. Each team would be responsible for a geographic area of the city and would see a project through from scope development through construction. To further enable efficient project implementation, the division's business processes would also be redesigned.

Ownership, commitment, and accountability are key components of the Infrastructure Project Management Team approach.

DDOT again called on the Volpe team to support and guide the redesign process, which required the collaboration and consensus of all division functions. In a series of meetings, the Volpe Center worked with a DDOT workgroup to:

- Analyze the root causes of the current situation;
- Interview stakeholders across the city and federal government to understand their requirements;
- Develop performance goals for the planning, design, procurement, and construction management of street and bridge construction projects;
- Redesign eight core business processes with the goal of streamlining the work and delegating as much as possible to the project teams; and
- Define clear roles and responsibilities for the project lifecycle from a project team perspective, with a focus on including external stakeholders at key decision points.

DDOT's project management team approach will:

- Enable faster delivery of services to customers;
- Minimize construction change orders by improving project scoping and design; and
- Strengthen relationships with stakeholders.

DDOT anticipates that the Infrastructure Project Management Team approach will better serve its mission of "providing safe and efficient movement of people and goods in and around D.C." The new approach benefits customers, employees, other stakeholders, and DDOT by improving communication, enhancing coordination, empowering staff, allocating necessary resources, and delivering improved goods and services. One anticipated result is a reduction of project lifecycles by at least 50 percent.

In May 2002, the Volpe team submitted a Draft Team Handbook to DDOT that will provide the Infrastructure Project Management Teams with the information, tools, and resources for successful project implementation. After the handbook is finalized, Volpe staff will train Project Management Team staff, and will consult with Project Management Team leaders.

Volpe's Planning and Policy Division supports the DDOT in its efforts to improve transportation infrastructure management, as well as transportation planning. (Photo courtesy of Getty Images)

Volpe's successful organizational development work has led the DDOT to request the Center's involvement in further organization support and in transportation planning. Volpe staff will assist DDOT in:

- Coordinating its business processes with the Federal Highway Administration D.C. Division Office;
- Developing a more effective process for Equal Employment Opportunity compliance;
- Evaluating the business process and organization redesign implementation after one year;
- Reorganizing other administrations in DDOT; and

- Working with the Downtown Congestion Management Task Force and other stakeholders to reach consensus on traffic mitigation/management strategies to address the Pennsylvania Avenue closure and downtown parking.

Papers & Presentations

- Ms. Jane Lappin of the Economic and Industry Analysis Division was guest editor of the January - February 2002 issue of *TR News*, titled "Intelligent Transportation Systems: Determining Directions." TR News is the bimonthly magazine of the Transportation Research Board (TRB). The editors defined and edited articles addressing social, engineering, and planning issues of relevance to the future development of Intelligent Transportation Systems (ITS). Ms. Lappin's editorial colleagues were Mr. Richard Weiland, chair of the TRB ITS Committee; Dr. Steven E. Schladover, University of California at Berkeley Partners for Advanced Transit and Highways; and Mr. William Johnson, formerly of Transport Canada. The magazine included an article co-authored by Ms. Lappin on traveler response to advanced traveler information systems.
- Mr. Gregg Fleming and Mr. Christopher Roof of the Environmental Measurement and Modeling Division participated in the Working Group Meeting on Aircraft Noise of Committee A-21 of the Society of Automotive Engineers. The meeting, held in Oslo, Norway, May 14 through 16, 2002, included representatives from the National Aeronautics and Space Administration, the International Civil Aviation Organization, the international aircraft industry, and regulatory agencies. Mr. Fleming presented a paper on lateral attenuation of aircraft sound, and Mr. Roof presented a paper on atmospheric absorption of sound. They have recently collected data and developed algorithms essential to the development of standards in these two areas.
- Mr. David Read of the Environmental Measurement and Modeling Division presented three papers at the Working Group 1 (Noise) of the International Civil Aviation Organization's Committee on Aviation Environmental Protection, held in Savannah, Georgia, June 19 through 21, 2002. Participants included international representatives from the aircraft industry and regulatory agencies. Mr. Read presented "Proposed Replacement Text for Environmental Technical Manual Appendix 3," "Revision to Regulatory Text to Eliminate Clause Regarding Non-Positive Sound Pressure Levels," and "Revision to Regulatory Text for Background Noise Adjustment."

Volpe's Environmental Measurement and Modeling Division supports the FAA and NASA in the development and maintenance of the Integrated Noise Model, a computer model for measuring airport noise. Above, Volpe equipment measures the noise levels of a commercial airliner. (Photo courtesy of Mr. Gregg Fleming)

- Volpe Center staff participated in the 27th Annual Conference of the National Association of Environmental Professionals in Dearborn, Michigan, June 24 through 27, 2002.
  - Dr. Aviva Brecher of the Office of Environmental Preservation and Systems Modernization served as Transportation Track Chair. Dr. Brecher organized three paper sessions and three panel sessions with Green Transportation themes. The paper sessions were titled “Environmental Compliance Challenges for Transportation,” “Best Practices in Transportation Planning and Streamlining NEPA,” and “Technologies and Policy for Greener Transportation.” The three panel sessions were titled "Assessing and Reducing Transportation Contributions to Climate Change," "Meeting Environmental Challenges," and "Hydrogen Powered Vehicles: Pathways and Challenges."
  - Mr. William Chernicoff of the Advanced Vehicles Technologies Division presented the paper, “Promising Transit Application of Fuel Cells and Alternative Fuels," coauthored by Mr. Chernicoff, Dr. Aviva Brecher, and Mr. Kevin Green of the Transportation Strategic Planning and Program Development Division.
  - Mr. Kevin Green discussed "Fuel Options for Reducing Emissions from Motor Vehicles"(on behalf of Mr. Don Pickrell of the Office of System and Economic Assessment) and "Transportation and Emissions Trading" in the panel session on transportation and climate change.
  - Mr. Brian Kim of the Environmental Measurement and Modeling Division was a panelist in the session “Meeting the New Environmental Challenges.” He presented the paper “Current Volpe Air Quality Support Work for the FAA.”
  - Dr. Amishi Joshi of the Environmental Engineering Division presented the paper, “The U.S. Maglev Deployment Program NEPA Compliance Process” coauthored by Dr. Joshi and Dr. Paul Valihura, also of the Division.

Director’s Notes

Continued from page 1

The Volpe Center has developed a core capability to assess the vulnerabilities of components of the transportation enterprise by combining systems engineering with operations and planning expertise.

The Center designed and implemented integrated security systems for the Department of Treasury’s Bureau of Engraving and Printing, the Department of State, and the U.S. Capitol, and is now supporting upgrades of these systems. Recently, the Center developed a vessel identification system that will help protect maritime targets.

The goal of consequence management is to minimize the destructive effects of an attack. Studying the management of past terrorist events provides helpful lessons. Being prepared for such events can lessen their impact, even when horrendous events, such as those that took place on September 11, 2001, have not been predicted. As described in this issue of Highlights, the Volpe Center has examined the responses to four recent catastrophic events, including the attacks on the World Trade Center and the Pentagon, and their effects on local transportation systems. Volpe’s work analyzes how transportation agencies have responded to security-related problems and identifies improvements that could be made. Best practices in the transportation community are being examined and shared for implementation where appropriate as part of planning for future emergencies.

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